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# Agricultural Experiment Station

*College of Agriculture, West Virginia University*

N. J. Giddings, Acting Director  
Morgantown

## *Varietal Experiments With Tobacco*



A ladder for hauling tobacco without injury

By

T. C. McILVAINE and R. J. GARBER

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# *Varietal Experiments With Tobacco\**

The production of tobacco in West Virginia is largely confined to a section embracing eight counties in the southwestern part of the State. These counties are Cabell, Lincoln, Putnam, Mason, Wayne, Jackson, Boone, and Kanawha, of which the first three named produce approximately five million of the seven and one-half million pounds produced annually in the State.

The varieties of tobacco grown in this section belong, in the main, to the Burley type which is used primarily for the manufacture of chewing and smoking tobaccos. Inasmuch as no definite experimental evidence as to the relative values of the different varieties grown in this section was available, varietal experiments were begun in the spring of 1922, at the Lakin substation in Mason County.

## **EXPERIMENTAL METHODS AND SOURCES OF VARIETIES**

### **Soil Treatment**

The plots on which the varietal experiments were carried out were situated on first bottom land near the Ohio River. The soil was a highly productive Huntington silt loam which had been in grass for several years previous to its use for experimental purposes. The grass sod was plowed in 1921 and planted to corn. In two of the four years in which the varietal experiments were underway, tobacco followed corn and in the other two years tobacco followed oats.

No fertilizer was applied to the tobacco or to any crop preceding it. The cropping plan followed and the lack of a fertilizer treatment were not necessarily recommended practices. This procedure was followed in this case because of certain other experiments under way.) In the spring of 1925 a heavy cover crop of rye was turned under for the tobacco.

### **Varieties**

In Table 1 are listed the source of seed and the seventeen varieties and strains of tobacco which were tested during the four-year period,

\*The tobacco experiments at Lakin are carried on in cooperation with the Office of Tobacco Investigations, Bureau of Plant Industry, United States Department of Agriculture. The writers are indebted to Dr. W. W. Garner, Chief of that Office, for valuable suggestions and for the photographs used in this bulletin. Submitted for publication May, 1926.

from 1922 to 1925, inclusive. Seed of most of the varieties was obtained from the United States Department of Agriculture, Office of Tobacco Investigations. Five strains were obtained from the Kentucky Agricultural Experiment Station, and one strain from the Huntington Tobacco Warehouse.

The variety designated as W. B. U. V. is a strain of drooping Burley, resistant to root-rot, which was developed at the University of Wisconsin. The five lots designated as S. B. No. 1, No. 9, No. 9a, No. 10 Ba, and No. 10 Fa, were, at the time of their introduction, third or fourth generation selections made in a cross between W. B. U. V. and Judy's Pride, a strain of Standup Burley. Beinhart is a pure selection of the drooping type of Kentucky White Burley. The strain A. S. 7 is a selection from Vimont-Kelley and is resistant to root-rot. The history of the strain grown as Kentucky Selection is not known.

**TABLE 1.—Tobacco Varieties Tested and Sources of Seed with Reaction to Root-rot and Character of Growth.**

Names of Varieties or Strains	Sources of Seed	Reaction to Root-rot	Character of Growth
Kelley	Ky. Exp. Station	Non-resistant	Standup
S. B. No. 1	U. S. Dept. of Agr.	Resistant	Standup
No. 9	U. S. Dept. of Agr.	Resistant	Standup
No. 9a	U. S. Dept. of Agr.	Resistant	Standup
No. 9Ba	U. S. Dept. of Agr.	Resistant	Standup
No. 9Fa	U. S. Dept. of Agr.	Resistant	Standup
Kentucky Selection	Ky. Exp. Station	Resistant	Standup
A. S. 7	Ky. Exp. Station	Resistant	Standup
Judy's Pride	U. S. Dept. of Agr.		Standup
Pepper	Ky. Exp. Station		Standup
Beinhart Sel. 1917	U. S. Dept. of Agr.		Non-standup
W. B. U. V.	U. S. Dept. of Agr.	Resistant	Non-standup
Halley	U. S. Dept. of Agr.		Non-standup
White Twist Bud	U. S. Dept. of Agr.		Non-standup
Red	Ky. Exp. Station		Non-standup
Lockwood	U. S. Dept. of Agr.	Non-resistant	Non-standup
Lockwood	Huntington Tobacco Warehouse	Non-resistant	Non-standup

Table 1 also shows the reaction of some of the strains of tobacco to root-rot and the growth habit ("standup" or "non-standup") of all the strains in the test. The "standup" types have erect leaves, whereas the "non-standup" types have more or less drooping leaves.

### Growing the Crop

The plants for the varietal experiments were produced in the usual manner. Seed was sown about the middle of March in a prepared

bed-bed at the rate of a scant teaspoonful per 100 square feet of surface. The seed was mixed with ashes to facilitate a uniform distribution in sowing. After the seed was sown the surface of the entire seed bed was tramped firmly and then covered with a good grade of tobacco muslin. It was necessary, of course, to keep the seed bed well watered. The seedlings were transplanted to the plots between June 1 and 10.

The plants were grown in rows  $3\frac{1}{2}$  feet apart and spaced 18 inches apart in the rows. During the first three years of the experiment each plot was made up of three rows with fourteen plants per row. Only the twelve inner plants of the middle row were harvested for the yield data. In 1925 each plot was made up of four rows of the same length as in previous years and the yield record was obtained from twenty-four plants of the two inner rows. End plants were discarded. In 1923 each variety was grown in five plots, and in 1922, 1924, and 1925 in four plots, systematically distributed over the entire experimental field. During the latter two years every third plot was used as a check.

When the tobacco on any particular plot was fully matured, the stalks were split, cut, and then spudded. Six plants were placed on a rack. In this condition, they were transported to a scaffold where they remained until well wilted and then were hung in the tobacco curing barn.



A scaffold in the field to facilitate the wilting of tobacco.

## Grading

Each year the tobacco was carefully graded. The sticks of tobacco were taken to a conditioning cellar until in proper "case" for handling. A sky-light in the grading room increased the intensity and uniformity of the light.

When the leaves were stripped from the stalks they were divided into a maximum of sixteen different grades, dependent on quality. The principal grades recognized by the Burley Tobacco Growers Cooperative Association are: A, flyings; B, trash; C, lugs; D, bright leaf; E, red leaf; F, heavy tips; F. S., smok-



A tobacco plant with a 16-pound mar paper bag in place to prevent cross-pollination.

ing tip; C. W., cigarette wrapper; and T. W., twist wrapper. Each of these grades, except the "smoking tip" and the two "wrappers," is divided into seven classes, number one being the best and number seven the poorest of a particular grade. In 1925, through the courtesy of the Huntington Branch of the Burley Tobacco Growers' Cooperative Association, it was possible to study the general relation between the grading of the varieties at the substation and the official grading of the same varieties, at Huntington. The results of this study are recorded in Table 2.

The vertical columns in Table 2, numbered from one to sixteen, contain the grades of tobacco made at the Lakin substation, and the twenty-two horizontal rows, labeled A7, A6, etc., contain the official grades of tobacco made at Huntington. Beginning at the upper left-hand corner of Table 2 the official grades reading from the top down and the grades made at the substation reading from left to right are arranged in the same order. Although the official grades and the substation grades do not exactly correspond, the relative position of the grades in one system as arranged in the table corresponds with that in the other system. In general, the substation grades are somewhat more inclusive than the official grades.

TABLE 2.—Correlation Between the Official Tobacco Grades of the Burley Tobacco Growers' Cooperative Association and the Grades Established at the Lakin Substation for the Varieties of Tobacco Grown at Lakin in 1925.

Official Grades	Sub-station Grades																Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
A7	45																45
A6	58																58
A5	2	4	3														9
A4		12		1	1												14
B7		1	1	7	14												23
B6		73	14		16		3	1									107
B5		9	1	7	49		8	17	5	1							97
B4					1		20	19	6	4	1						51
B3							5	9									14
B2								5	4	7	1	1					27
C7		6			3												125
C6				1	7		6	21	36	27	17	10					127
C5							15	17	36	37	17	5					11
C4								1	4	5	1						96
D6										6	35	43	12	1			41
D5										7	18	13	2	1	8		12
E7													1	1			57
E6										1	1	1	38	8	9	5	27
E5											3	3	16				23
E4												1	22				46
F5															1	45	71
F4													1		20	50	58
F3															55	2	
Total.....	105	105	19	16	91		57	90	91	95	94	78	93	10	93	102	1139

Under substation Grade 1, 105 samples were found which were placed in this grade. This same tobacco at Huntington was placed mainly in official grades A7 and A6. Similarly, there were 105 samples which were placed in substation Grade 2, and this same tobacco was placed chiefly in official grade B6. It is evident from Table 2 that in general there was a fairly close agreement between the substation grades and the official grades, although considerable variation occurred in certain instances.

In 1925 the difference between the average value of the varieties per acre, based on the official grades, and that based on the substation grades, was \$1.80. Prior to 1925, only the substation grades were available and it was upon the basis of these grades that yields and values were determined. In view of the correlation of grades by the two systems, the yields and values based on the substation grades may be considered as a trustworthy index of the yields and values based on the official grades.

### Data Collected in 1925

As has been previously stated, the tobacco produced on each plot in 1925 was first graded and labeled, and then shipped to the Huntington Branch of the Burley Tobacco Growers' Cooperative Association where it was regarded according to official standards and then sold on the leaf tobacco market. The average yield of tobacco in pounds per acre and its value for each variety are shown by grades in Table 3.

In columns 2, 4, 6, and 8 are given the yields per acre in pounds for grades A7 and A6, A5, and A4, respectively. (These yields are recorded in round numbers only. On the other hand the values recorded in the adjacent columns were computed by multiplying the weight, carried to one decimal, by the auction price per hundred pounds, which may be found at the bottom of the table.) Of the four classes of tobacco just mentioned, A4 on the average commands the highest price on the market. Considering all the classes of the grade (flyings) together, it is apparent that Lockwood (U. S. D. A. and White Twist Bud each produced considerable more tobacco of the grade than did any other variety in the test. Beinhart, Judy's Pride No. 10 Ba, No. 9a, and S. B. No. 1 each produced somewhat more than 250 pounds of A grade tobacco. The least amount of this grade tobacco was produced by Pepper which was closely followed by A. 7 and No. 10 Fa.

In a similar manner, the yields of the several varieties and strains of tobacco, with respect to grades B, C, D, E, and F, might be discussed. This does not seem worth while, however, in view of the fact

at the data in Table 3 are from only one year's work. The table is published in extended form, primarily to show the different grades of tobacco produced by the several varieties in the test.

The values of the various grades at the time the 1925 crop was marketed are also shown. In general, grades A4, B7, B6, B5, B4, B3, and C5 brought the highest prices per pound, whereas grades E7, F4, and F5 brought the lowest. Considering the last four grades together, it may be of some interest to point out which varieties produced relatively high and which relatively low yields. Lockwood (U. D. A.) was the highest producer of the low grades with a total of 4 pounds, and the Huntington strain of Lockwood came second with total of 379 pounds. The varieties No. 9, No. 10 Ba, Kentucky Selection, A. S. 7, Beinhart, and Halley ranged in production of these inferior grades from 306 to 337 pounds. Two varieties gave low yields, namely, Pepper with a total of 163 pounds and Red with a total of 167 pounds.

The ratios (expressed in percentages) of the total average yield (columns 8, 10, 12, 14, 16, 18, 20, and 22, Table 3) of the aforementioned more valuable grades, to the total average yield (column 46) of the crop for each variety in 1925, have been calculated and are given in the following list, in which the varieties are arranged in a descending order with regard to their ratios. In other words, the varieties which are named first produced the greatest relative amount of high grade tobacco. The varieties together with their percentages of good grade tobacco are as follows: Kelley, 58; Pepper, 55; No. 10 Ba, 51; Kelly's Pride, 41; No. 10 Fa, 40; No. 9, 37; A. S. 7, 33; Lockwood (U. D. A.), 31; W. B. U. V., 30; Lockwood (Huntington), 30; Beinhart, 28; Kentucky Selection, 28; No. 9a, 26; Red, 22; S. B. No. 1, 21; Halley, 18; and White Twist Bud, 13. It is apparent that in 1925 Kelley, Pepper, and No. 10 Ba produced the highest percentages, by weight, of the better grades of tobacco.

### DATA COLLECTED DURING FOUR YEARS

It has already been stated that in 1922, 1923, and 1924 the several varieties and strains of tobacco in the experiments herein reported were graded only at the Lakin substation. The tobacco on each plot was graded and the weight of each grade determined in a manner similar to that followed in 1925. Each grade was given a value based on current market prices for that particular year. In this way the data were recorded and collected in a table each year somewhat like Table 3 except that the yields and values were based on the tobacco grades made up at the substation.

TABLE 3.—Average Yield of Tobacco in Pounds Per Acre and Its Value by Grades as Determined on the Huntington Market, for Each of the Seventeen Varieties and Strains Grown at the Lakin Substation in 1925.

VARIETIES AND STRAINS	OFFICIAL TOBACCO GRADES							
	A7		A6		A5		A4	
	Yields in Pounds	Values	Yields in Pounds	Values	Yields in Pounds	Values	Yields in Pounds	Values
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Kelley.....	74	\$17.68	110	\$26.31	13	\$3.03	6	\$1.73
S. B. No. 1.....	275	66.02						
No. 9.....	115	27.62	11	2.74			77	20.90
No. 9a.....			205	49.20			50	13.37
No. 10 Ba.....	74	17.83	98	23.59			88	23.76
No. 10 Fa.....	83	19.80	91	21.86				
Kentucky Selection.....	98	23.59	89	21.31				
A. S. 7.....	69	16.61	112	26.78				
Judy's Pride.....	104	25.01	87	20.98			69	18.74
Pepper.....			118	28.34	46	10.92	96	25.92
Benhart.....	72	17.18	118	28.32				
W. B. U. V.....	42	9.96	156	37.49				
Halley.....	37	8.83	118	28.34	82	19.75		
White Twist Bud.....	56	13.49	209	50.06			121	32.56
Red.....	35	8.28	95	22.68			67	18.00
Lockwood (U. S. D. A.).....	153	36.72	81	19.34			211	57.05
Lockwood (Hunt).....	19	4.58	152	36.40	65	15.65		
Auction price per cwt.....		\$24.00		\$24.00		\$24.00		\$27.00





TABLE 3.—Concluded.

## OFFICIAL TOBACCO GRADES

VARIETIES AND STRAINS	E7		F3		F4		F5		Total		Values Per cwt. (48)
	Yields In Pounds	Values (39)	Yields in Pounds (40)	Values (41)	Yields in Pounds (42)	Values (43)	Yields in Pounds (44)	Values (45)	Yields in Pounds * (46)	Values (47)	
(1)	(38)	(39)	(40)	(41)	(42)	(43)	(44)	(45)	(46)	(47)	(48)
Kelley.....	3	\$ .43	102	\$16.39	91	\$13.66	33	\$5.02	1,917	\$478.71	\$24.97
S. B. N2. 1.....			194	31.04	37	5.58	77	11.61	2,013	480.91	23.89
No. 9.....			152	24.38	127	19.04	27	4.01	1,809	434.45	24.01
No. 9a.....			130	20.80	95	14.21	21	3.15	1,980	478.90	24.17
No. 10 Ba.....			202	32.37	76	11.40	29	4.32	1,989	488.76	24.57
No. 10 Fa.....			116	18.62	80	11.94	92	13.77	1,884	453.54	24.07
Kentucky Section .....	119	19.09	84	13.41	105	15.69	29	4.37	1,988	469.31	23.63
A. S. 7.....	126	20.18	110	17.55	33	4.95	59	6.90	2,097	508.10	24.23
Judy's Pride.....			102	16.26	97	14.52	95	14.30	1,999	491.35	24.58
Pepper.....			51	8.22	112	16.76			1,931	486.30	25.18
Beinhart.....			166	26.56	61	9.15	83	12.41	2,159	515.84	23.89
W. B. U. V.....			50	7.92	44	6.60	130	21.52	1,887	431.15	23.90
Halley.....			109	17.44	139	20.85	61	9.21	1,846	422.38	22.89
White Twist Bud.....	137	21.86			101	15.18	57	8.52	2,245	520.35	23.20
Red.....	37	5.89	36	5.79	43	7.10	51	7.70	2,069	494.77	23.91
Lockwood (U. S. D. A.).....	151	24.08	82	13.10	120	18.00	51	7.71	1,910	446.96	23.40
Lockwood (Hunt.).....			298	47.74	49	7.29	32	4.74	1,937	458.61	23.67
Auction price per cwt.....		\$16.00		\$16.00		\$15.00		\$15.00			

\*Total weights by variety as based on yields for each grade and recorded to one decimal, but with fractions dropped in totals.

The total average yield of tobacco in pounds per acre and the estimated total value for each variety, for each of the three years 1922, 1923, and 1924, are brought together in Table 4. In the same table are shown the total average yields and the actual values of the 1925 crop, based on the official grades, on the Huntington market.

In column 1 of Table 4 the varieties and strains of tobacco are arranged according to the values of their average annual yields, which are recorded in column 11. The average annual value for any particular variety was obtained by adding together the yearly values for that variety recorded in columns 3, 5, 7, and 9 and dividing the sum by four. The average yields in column 10 are obtained in a similar manner. The value per hundred pounds of tobacco (column 12) for any variety was computed by dividing the average value of the variety by its average yield in pounds and multiplying the quotient by 100.

Considering the varieties which were grown for four years, it is apparent from column 11 that there were four of them whose yields had an average annual value somewhat greater than \$500 per acre. These varieties were White Twist Bud, Red, Pepper, and Kelley, of which, the first named variety had considerably the highest value. The three varieties with the lowest average annual value were No. 10 Fa, W. B. U. V., and No. 9.

The rank of the four varieties which gave the highest average yields (column 10) is the same as their rank with respect to average annual values. The average yield per acre of White Twist Bud (heavy dark tobacco) was 2,264 pounds; of Red, 2,144 pounds; of Pepper, 2,043 pounds; and of Kelley, 2,016 pounds. The first two varieties gave average annual yields of more than 100 pounds in excess of the last two varieties.

With respect to average values per hundred pounds of tobacco (column 12), Kelley (\$25.00) ranked first, Pepper (\$24.73) second, Red (\$23.66) third, and White Twist Bud (\$23.55) fourth. It should be noted that the rank of these four varieties with respect to average values per hundred pounds is just the reverse of what it was with respect to average yields (column 10) and average values (column 11). The extreme difference in the average values per hundred pounds of the four varieties is \$1.41.

Beinhart was grown in only three of the four years in which the experiment was under way, but in each of those three years it ranked near the top with respect to yield and value.

TABLE 4.—Summary of the Tobacco Yields and Values Per Acre for the Seventeen Varieties and Strains Grown at the Lakin Substation from 1922 to 1925, Inclusive.

VARIETIES AND STRAINS	1922†		1923†		1924†		1925†		Average		Value per cwt.
	Yields in Pounds	Values	Yields in Pounds	Values	Yields in Pounds	Values	Yields in Pounds	Values	Yields in Pounds	Values	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
White Tw st Bud.....	2,236	\$661	2,177	\$445	2,399	\$507	2,245	\$520	2,264	\$533	\$23.55
Red.....	1,716	480	2,508	566	2,283	488	2,069	495	2,144	507	23.66
Pepper.....	2,281	633	1,970	452	1,990	450	1,931	486	2,043	505	24.73
Kelley.....	1,999	547	2,160	515	1,989	478	1,917	479	2,016	504	25.00
A. S. 7.....	1,800	506	2,192	460	1,954	406	2,097	508	2,011	470	23.37
Lockwood U. S. D. A. ....	2,024	519	1,974	427	2,132	446	1,910	447	2,010	460	22.88
Lockwood (Hunt).....	1,996	521	1,940	433	2,046	424	1,937	459	1,980	459	23.18
Halley.....	2,410	645	1,793	391	1,809	375	1,845	422	1,965	458	23.32
Kentucky Selection.....	1,871	479	2,180	535	1,665	345	1,988	469	1,926	457	23.72
Judy's Pride.....	2,024	526	1,926	439	1,855	391	1,999	465	1,946	455	23.40
No. 10 Ba.....	2,070	583	1,716	365	1,548	345	1,989	489	1,831	446	24.33
No. 9a.....	2,099	541	1,690	378	1,640	350	1,980	479	1,852	437	23.60
S. B. No 1.....	1,879	500	1,823	385	1,679	361	2,013	481	1,849	432	23.39
No. 9.....	2,028	523	1,787	388	1,723	369	1,809	434	1,837	429	23.33
W. B. U. V.....	1,996	495	1,793	398	1,722	357	1,887	451	1,849	425	23.00
No. 10 Fa.....	1,970	448	1,734	391	1,767	399	1,884	454	1,839	423	23.00
Reinhart.....	2,614	724			2,234	474	2,159	516	2,336*	571*	24.44*

\*Average of only three years.

†Values for 1922, 1923, and 1924 are estimated; 1925 values are actual.

## CONCLUSION

Under the conditions of the tobacco varietal experiments described in this bulletin, the varieties White Twist Bud, Red, Pepper, and Kelley had the greatest average values per acre for the four years the experiment was under way. Kelley and Pepper were somewhat superior in quality to White Twist Bud and Red.

On the basis of only three years' work, Beinhart gives promise of being a high yielder for the locality in which it was tested.





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**JUNE 99**

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